SCIENCE

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ASIDE FROM ITS ECONOMIC IMPORTANCE, which cannot be exaggerated, Major Powell's letter to the New Orleans Chamber of Commerce, printed in full on another page of *Science*, on the relief of the alluvial lands of the lower Mississippi from destructive floods, contains the first formal announcement of a new law in the hydraulics of rivers. It is set forth in these words: "The cutting power of a stream increases rapidly with the increase of sedimentary load." This principle was briefly stated by Major Powell in a short oral address before the American Association for the Advancement of Science, about ten years ago, and he has indirectly referred to it two or three times since, in a word or two, in his writings; but this is the first specific statement of it that he has made, and this he considers as barely more than indicating the line of discussion which he has long intended to pursue in a volume that he proposes to write upon the subject. But the principle is stated in this paper with sufficient detail and illustration to arrest the attention of physicists and engineers, and to give rise to an interesting discussion. This Major Powell invites, and the columns of *Science* will be gladly placed at the disposal of any of its readers who may desire to express an opinion, either favorable or unfavorable, to the new theory.

IT IS CHEERING to note that another step in advance in the line of statistical science has recently been taken. A year ago Colonel Wright made a marked impression by demanding that statistics be given a place in the collegiate curriculum. Now the American Statistical Association, which possesses a quiet history of forty years in its records, announces a publication, to appear at regular intervals, devoted to the interests of statistics. This association in the past has been practically but a local society of Boston, formerly fostered by the late Dr. Jarvis, so eminent in the field of vital statistics, and at the present time officered by General Walker (its president), and Mr. Edward Atkinson (its corresponding secretary). The association welcomes to membership all who are interested in statistical work, and hopes in the future to be able to issue a representative journal which may compare favorably with similar European publications. There is no reason why this cannot be done. In no country is the utility and application of statistics more generally recognized than in the United States: it only remains to create an intelligent interest in their proper collection and tabulation. The venture of the publication of a work upon technical statistics, like that of Mr. Pidgin, entitled 'Practical Statistics,' furnishes added testimony to the development in progress. We also understand that during the past year a course upon statistics has been introduced at the University of Michigan, under the direction of Prof. Henry C. Adams.

PREVENTION OF FLOODS IN THE LOWER MISSISSIPPI.

POPULAR interest in the proposed investigation by the United States Geological Survey, of the problem of storing the waters of the upper Missouri and other Far Western rivers in great reservoirs, and the reclamation by irrigation of vast areas of what are now waste lands, spreads as some of the incidental effects of those great works, should they be undertaken, are beginning to be understood. An illustration of this is a letter from the New Orleans Chamber of Commerce to Director Powell, asking him what the effect of the proposed reservoir system will be upon the commercial and agricultural interests of the lower Mississippi. In reply he has prepared and forwarded the following paper, which, aside from the economic possibilities it suggests, is an important contribution to the scientific discussion of the hydraulics of the Mississippi River. The paper is given in full.

The control of the lower Mississippi is a problem of great magnitude, and the conditions are of great complexity. The end to be attained is to give the channel stability of position, and sufficient depth and breadth to make it a perfect conduit, capable of transporting to the sea all the water sent down by floods, thus relieving the adjacent country from danger of overflow. To accomplish this end it is necessary (1) to prevent the choking of the channel by excessive sedimentation, and this is the most important remedy; and (2) to diminish the volume of the floods by the storage of water above at flood-time; this is an accessory but important remedy. The relief of the river from excess of sediment, and the storage of the superabundant water at flood-time, may be accomplished by the same method, and its accomplishment may also involve the irrigation of the arid lands on the eastern slope of the Rocky Mountains. All this must be set forth more fully.

The Mississippi and its tributaries receive and transport to the sea the drainage of about 1,250,000 square miles. To obtain an idea of the work done by this river system, some facts must be understood.

The volume of drainage passing New Orleans is, on the average, 675,000 cubic feet per second, or about 150 cubic miles per year. The average contributions in cubic feet per second of the principal tributaries in the system are, in round numbers, as follows:—

	Cubic Feet per Second.
Upper Mississippi	100,000
Missouri	120,000
Ohio	160,000
St. Francis	30,000
Arkansas and White	60,000
Yazoo	40,000
Red	60,000

A portion of the grand total poured into the valley below Cairo escapes through the Atchafalaya and other bayous even at average river stages, put probably not less than eighty per cent of that total finds its route to the sea at present by way of the Crescent City. During flood-stage the outflow by the same route rises to about one million cubic feet per second; but the rate of inflow into the valley may at such stages exceed twice the carrying capacity of the main branch of the Atchafalaya. Of the three main tributaries, the discharge has been found to rise during floods in the upper Mississippi and Missouri to three times, and in the Ohio to seven times, the average amount.

Such, in brief, are the most apparent facts as to the volume of drainage discharge. But these do not disclose two other facts which are of prime importance in the engineering problems presented by the Mississippi; viz., that this river is a river of mud from the Missouri to the Gulf, and that the Missouri is the principal source of mud-supply.

Much attention has been given recently by the Mississippi River and the Missouri River Commissions to observations of the amount of sediment in transport at various points along the Mississippi and Missouri. These observations show that near New Orleans the amount of sediment in transport varies from $\frac{1}{800}$ to $\frac{1}{7000}$ part of the total volume discharged, and averages about $\frac{1}{2000}$ part of that volume. Above the mouth of the Missouri the Mississippi carries much less sediment, the range being from $\frac{1}{800}$ to $\frac{1}{100000}$, with an average of $\frac{1}{4500}$ part of the volume. The Missouri, on the other hand, is always heavily loaded with sediment. Just above its point of confluence with the Mississippi the amount in transport varies